Course Syllabus

Western University
Faculty of Engineering
School of Biomedical Engineering

BME 3201A—Fundamentals of Biomedical Engineering Design

Course Outline 2022–23

**Description:** Biomedical engineering is a broad field of study, which involves applying the concepts, knowledge, and approaches of engineering to solve health care related problems. The objective of this course is to develop design skills and tools used in biomedical engineering design. An integration of the engineering and life sciences will be covered through the presentation of design principles for medical devices and systems.

**Instructor:** Dr. Emily Lalone PhD

TEB 361, 519-661-2111 ext. 88242 emily.lalone@uwo.ca

Office hours: Mondays 1:30-2:30pm

**Contact Hours:** 3 lecture hours, 0.5 course.

**Antirequisite(s):** MME 4470A/B.

**Prerequisites:** Students must have completed the entire first year program in Engineering, with no outstanding credits to be taken, and have a Year Weighted Average (YWA) of at least 80%, as well as permission from the School of Biomedical Engineering.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

**CEAB Academic Units:** Engineering Science 20%, Engineering Design 80%.

**Required Textbook:**

There is no required textbook for this course; however, the suggested text is as follows:

**Required Software:** Students are encouraged to use MATLAB, SolidWorks, or any other modelling or simulation software that they wish to use to validate their designs.

**Recommended References:** If applicable, other recommended readings will be made available through OWL.
General Learning Objectives (CEAB Graduate Attributes)

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<td>Life-Long Learning</td>
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Notation: $x$ represents the content level code as defined by the CEAB. blank = not applicable; I = introduced (introductory); D = developed (intermediate) and A = applied (advanced).

General Learning Objective:

At the end of this course, students will be expected to apply the biomedical engineering design process to solve a specific clinically driven problem.

Topics and Specific Learning Objectives

1. Biomedical requirements and specifications

   At the end of this section, students will be able to:

   a. Define design requirements by assessing the needs of clinical partners.
   b. Create specifications based on customer needs and prioritize design features.
   c. Investigate the state of the art and critically analyze existing solutions.

2. Biomedical design concepts

   At the end of this section, students will be able to:

   a. Consolidate specifications and perform a brainstorming session to ideate possible solutions.
   b. Create and sketch design solutions and investigate their advantages and disadvantages in a biomedical application.

3. Evaluation of biomedical designs

   At the end of this section, students will be able to:

   a. Implement tools specifically created to evaluate and critically analyze design concepts.
b. Perform a complete design of the device, system, or process and evaluate it via simulation and prototyping.

4. **Assessment and approval of biomedical products**

At the end of this section, students will be able to:

a. Design an experiment to evaluate the performance of a biomedical product.

b. Describe the steps needed to implement the product as a real solution in the BME field (e.g., ethics approval, Health Canada approval).

**Evaluation**

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<td>Class Attendance</td>
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<td>Design Project</td>
<td>50%</td>
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<tr>
<td>Oral Presentation</td>
<td>15%</td>
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<td>Quizzes</td>
<td>24%</td>
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**Class Attendance:** Students are expected to attend all class sessions and actively participate for the duration of the class. Each week will count for a 1% of the final grade, for up to 11 weeks of attendance. This means that students may miss a lesson without the need to explicitly request accommodation. Students attending all 12 weeks will receive a bonus 1% mark.

**Design Project:** A design project will be completed in teams (see Project tab on OWL for further details). The material will be submitted in 5 different steps, as follows:

**Step 1** (5%) Will consist of a preliminary report that outlines the team and the project. This report will include the biomedical motivation, objectives, planned methods, materials required, and timeline for project development. Deadline: September 23, 2022

**Step 2** (10%) Will consist of a report that summarizes the information that has been gathered, will expand on the biomedical need, and will explain how the specifications were developed. Deadline: October 7th, 2022

**Step 3** (10%) Will consist of a report that outlines the process for concept generation and the possible concepts considered. Deadline: October 28th, 2022
**Step 4** (10%) Will consist of a report that explains how the design concept was selected and details the conceptual design. Deadline: November 18th, 2022

**Step 5** (15%) Will consist of a report on the complete design. This report can include the previous reports, which can be updated according to the feedback received. It must also outline the final product and its evaluation. Teams must also clearly explain how the design meets the biomedical requirements, and the limitations of the current prototype. Deadline: December 2nd, 2022

**Oral Presentation:** The team will present their design as a 10 minute sales pitch to the customer. This presentation will take place on December 6th, 2022. Further instructions will be provided on OWL.

**Quizzes:** A total of seven quizzes will take place at the end of class on the dates indicated below. These tests will be closed book. Each quiz will count for 4% of the final grade. The grade for the 6 highest marks will be considered towards the final grade.

If a student misses a quiz, it will not be rescheduled regardless of the circumstances for which the quiz was missed. The student must first request accommodation from Undergraduate Services, and then contact the instructor. The instructor will decide whether to allow the reweighting of the quiz, where reweighting means that the marks normally allotted for the quiz will be added to a different component of the course. If no reasonable justification for missing the quiz can be found, then the student will receive a mark of zero for the quiz.

**Tentative quiz dates:**

- September 23rd, 2022
- September 27th, 2022
- October 4th, 2022
- October 18th, 2022
- November 8th, 2022
- November 22nd, 2022
- November 29th, 2022

**Online Activities:** Lecture material will be posted on OWL prior to each scheduled lecture. Project reports will be submitted online in the assignments page.

**How to succeed in this course:** Adhere to the week-to-week requirements as outlined in each unit. While every student works at a different level, it is the effort placed in each requirement that ultimately leads to success. Your interest in the course, participation in the course by asking relevant questions, and communicating with the instructor, will all contribute to your successful completion of project and quizzes. Note that it is your responsibility to determine what is required of you. Read through the online materials, course outline, and emails from the instructor, to determine the instructions regarding course deliverables.

**Use of English:** In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for improper use of English. Additionally, poorly written work, with the exception of the final examination, may be returned without grading.
resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

**Attendance:** All classes are mandatory, health permitting. Any student who, in the opinion of the instructor, is absent too frequently from class periods will be reported to the Dean (after due warning has been given). On the recommendation of the department, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

**Absence Due to Illness or Other Circumstances:** Students should immediately consult with the instructor or School Director if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see the attached “Instructions for Students Unable to Write Tests or Examinations or Submit Assignments as Scheduled”). The student should seek advice from the instructor or School Director regarding how best to deal with the problem. Failure to notify the instructor or School Director immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

For more information concerning medical accommodations, see the relevant section of the Academic Handbook:

[http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf)

For more information concerning accommodations for religious holidays, see the relevant section of the Academic Handbook:


**Cheating and Plagiarism:** Students must write their reports and quizzes in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com ([http://www.turnitin.com](http://www.turnitin.com)).

Scholastic offences are taken seriously, and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook:

**Use of Electronic Devices:** Electronic devices are allowed during all sessions, except while quizzes are being completed. Other than the necessary devices needed to read the question and submit the responses, no other electronic devices may be used during quizzes.

**Policy on Repeating All Components of a Course:** Students who are required to repeat an Engineering course must repeat all components of the course. No special permissions will be granted enabling a student to retain any marks from previous years. Previously completed project reports and quizzes cannot be resubmitted by the student for grading in subsequent years.

**Internet and Electronic Mail:** Students are responsible for regularly checking their Western e-mail and the course web site ([https://owl.uwo.ca/portal/](https://owl.uwo.ca/portal/)) and making themselves aware of any information that is posted about the course. If the student fails to act on information that has been posted on these sites and does so without a legitimate explanation (i.e., those covered under the illness/compassionate form), then there are NO grounds for an appeal.

**Accessibility:** Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 519-661-2111 ext. 82147 for any specific question regarding an accommodation.

**Support Services:**

- Student Development Centre, [http://www.sdc.uwo.ca/](http://www.sdc.uwo.ca/)
- Engineering Undergraduate Services, [http://wwweng.uwo.ca/undergraduate/](http://wwweng.uwo.ca/undergraduate/)
- USC Student Support Services, [http://westernusc.ca/services/](http://westernusc.ca/services/)

Students who are in emotional/mental distress should refer to Mental Health @ Western, [http://www.health.uwo.ca/mental_health/](http://www.health.uwo.ca/mental_health/), for a complete list of options about how to obtain help.